

in-families, generation upon generation, according to the laws of nature which govern the disposition of those bodies, or a chaotic mixture of reliques of numerous species, but all inhabitants of the same climate. Sometimes the aggregate consists of lacustrine and oceanic reliques; at other times with these we find terrestrial organic remains: in all, we find the operation of ages, and the forming effects of climate.

The term chalk is applied to a group of deposits very dissimilar in their lithological composition, but agreeing in their character of oceanic organic bodies. In Europe the chalk formation extends over a great portion of the British Isles, Northern France, Germany, Denmark, Sweden, and Russia; there are also extensive formations in North America. In the United States there is very little chalk: in India the chalk is generally converted into marble in its varieties, jasper, porphyritic and other rocks: in China its constituents form the basis of marbles and clays.

In England, much of the chalk strata exhibits alternate layers of flints and chalk, or otherwise the flints are generally but irregularly diffused throughout the aggregate mass. The hills which form the boundaries of Upper Egypt are of similar composition and character, although of much more recent origin; these, and other ranges extending through various parts of the Egyptian and Nubian deserts, are in general the work of madrepores, millepores, and other oceanic species, presenting various aspects of change, some of them being consolidated, as limestone; others, where removed from the influence of the atmosphere, in the soft state denominated chalk, the latter indurating when exposed to the action of the sun and air. The catacombs running into the very heart of these hills afford the lover of research into Nature a noble opportunity of witnessing her protean powers. Upon entering into one or more of these catacombs, the first chamber, if for some time exposed to the atmospheric influence, presents the appearance of progressive change in the unity of parts and quantities, the matrix is carbonate of lime variably indurated, and some portions of which are beautifully encrusted with a pure quartz formed by the exuding silica; irregularly disposed throughout are fossil mollusca, and other fish and reliques, gradually converting, or entirely converted into chalk, and generally retaining throughout their several stages of change their primary form; but on breaking a nodule, we can discover no trace of their orgadical arrangement. The fossils which are thus transmuted into chalk are generally those of the more bituminous animals, the silica and calcium of the animal being retained, but the ammonia being replaced or changed by carbon.

The protean powers of Nature are still more beautifully developed in the changes these bodies undergo. Thus, if one of these chalk nodules be accidentally disengaged from its matrix by the falling of a portion of the hill or otherwise, and become exposed to the intense heat of the valleys, it gradually indurates, becoming, in the early state of change, what is termed a petrification, but eventually it is converted into the precious and beautiful stone termed EGYPTIAN JASPER. Nor is this all; for as a chalk nodule, its internal configuration is obliterated; but in the perfect state, its whole interior economy is once more displaced, and generally sufficiently so as to distinguish the genera to which it belongs, and sometimes the cryptogamic plant attached to the animal in its living state. Yet let not the reader suppose that this alone is the cause of effects produced, as Egyptian jasper; in this, as in all things else, Nature has many ways of effecting the end desired. The valleys of those localities of which I am now speaking are covered with fossil bodies, preserved in the first instance from decomposition of parts by certain elementary proximate principles or compound bodies, with which they were primarily united; it is not at all necessary that the organic body should in the first instance become converted into chalk, for the tendency of all animal matter in these localities, and in all tropical climates, is to become mineralized, as agate, jasper, or some other calcedonic substance; the nature of the change and the ultimate result depending on the nature and qualities of the material with which they become accidentally united; and of the elements to which they are exposed. Animal matter is

the basis of all the rocks termed primary, and in most of them it forms the chief constituent; in like manner vegetable matter is the basis of most of the earth's marbles, and clays.

As an illustration of this, I notice the giant balani; these animals aggregate together in families, and are the living architects of immense edifices, building after the manner of the more minute polypl; these animals contain a great portion of animal matter. On the Arabian shores of the Indian Ocean there are vast aggregates of this genera changing or changed into *Rock Jasper*. Even in the bosom of the mountains running along this coast, two hundred feet above the present level of those waters, the same phenomena is exhibited; sometimes these animal rocks being in the first instance converted into chalk; at other times, in union with other marine animals, they become bituminized, the dark liquid sometimes escaping from its bed and running down the mountain sides; in some parts of the deserts, particularly near Egypt, there are entire hills wholly composed of particular genera of balani converted and converting into carbonate of lime. In some parts of Upper India they become converted into siderous rock, exceedingly hard, iron being the chief constituent.

In England the deposits are of the like primary nature, but the results proceeding from the influence of climate are remarkably different. Here the matrix originally formed by polypl is entirely decomposed, and having a strong affinity to carbon, which it rapidly absorbs, and which is rapidly developed in this moist country, where vegetation is so abundant, the whole mass becomes chalk, and the excess of silica falling on the bituminous animal bodies and aggregates, converts them ultimately into flint. The alternate layers of this material with chalk shew the primary disposition of the organic bodies, and mark the course of deposition in the ocean, and also the causes of effects thus produced as a stratum. There is an era of life, the genera and species being madrepores, millepores, corals, sponges, radiari, echinites, and other animals, of necessity when in the living state, the inhabitants of warm and tranquil seas; a periodical deposition of atomic particles of organic animals and vegetables, exclusively the creatures and plants of the ocean formed upon this stratum, and thus the fabric arises, death upon life, life upon death. The difference of the siliceous bed and the chalk bed is, that in chalk, the basis has an affinity to silica, and under favourable circumstances becomes siliceous; whereas in flint, the siliceous base is developed. In the flint, the internal and external organical structure of the animal is often manifest through all the changes it has undergone; in chalk, the organic structure is to all appearance entirely obliterated in the decomposition of parts.

The chalk formations are invariably the products of organic orders, genera, and species of the ocean, and such as of necessity exist only in warm and tranquil seas; all chalk formations originate in and by the operations of life, the elementary principles and compounds of which chalk is composed being secreted by life. The modifications and changes of organic matter depend upon local association, or local action and reaction of matter with matter, or upon the accidents of union, separation, degradation, and other causes. In this country the softer madrepores are, in general, silicified; but this is the final result, the intermediate changes varying from each other, being chalk, simple carbonate of lime, and sometimes the change is effected by transition direct from the animal matter.

When chalk nodules are exposed to the sun and atmosphere on rich black vegetable soils in Upper India, the nodule, in the course of time, becomes gradually transformed into chalcedony, generally laminated, semi-transparent, and having strong bands delineated: receiving into its composition alumina, it becomes converted into another kind of precious stone.

As in the times of flood, the great rivers of the earth force their passage through the ocean waters, and finally deposit therein the numerous proximate principles and compounds held in suspension by the fresher: so when these floods take place periodically, depositions upon oceanic matter, collected within those periods, take place in like manner: again, during the dry season of the year in tropical countries,

the large rivers losing their force and volume, the ocean waters, overcoming the force of resistance, pass up the mouths of the rivers for many miles, and there deposit matters, held in suspension by them, upon the bed of terrestrial matters; thus the TERTIARY STRATA originate. The like result is produced when the sea occasionally inundates the whole of an extensive tract lying below its level.

Lieutenant Nelson observes that the soft white calcareous mud of the Bermudas, distributed over the bottoms of the lagoons, is formed by the decomposition of *echinaria*, *flustra*, *cellepora*, &c.; and when dried, it is not to be distinguished from common chalk. Darwin makes the same observation, accompanied with the erroneous idea that they have passed through the body of worms.

The chalk formations, as Dr. Mantel observes, attest the high antiquity of the strata in Europe, because the period of their formation, and the ages which of necessity must have passed away in their gradual developments, goes far beyond the earliest records of man; they prove also that this earth has repeatedly changed in its orb of revolution; that life is the generator of substance as life, and ultimately of mineral bodies; that the earth increases by and in the operations of life, and that the waters diminish in the like degree, the elementary constituents of the waters undergoing a change and modifications of change, as they are received or absorbed within the living system, and also in mineral bodies; that as life is the generator of substance, and as life is of necessity locally disposed in its orders, genera, and species, so must the earth of necessity locally accumulate; and also that as matter is the passive subject of moving powers, so must it of necessity form local accretions, in or beyond the sphere of action; that the causes of effects produced, as chalk, are various, but that the primary cause being life, is one and the same; but that as life is divisible in its orders and genera, so the primary causes are many.

In the extensive valley of the Mississippi, the cretaceous formation is acknowledged by its fossils, but the rock does not assume the form of chalk.

(To be continued.)

RETROSPECTIVE ARCHITECTURAL LITERATURE.

THE ELEMENTS OF ARCHITECTURE.

COLLECTED BY SIR HENRY WOTTON, KNIGHT,
From the best Authors and Examples.

(Continued from p. 458.)

Now touching the Distribution of Lodging-Chambers; I must here take leave to reprove a Fashion, which I know not how hath prevailed through Italy, though without ancient Examples, as far as I can perceive by Vitruvius. The Thing I mean, is, that they so cast their Partitions, as when all Doors are open, a Man may see through the whole House; which doth necessarily put an intolerable Servitude upon all the Chambers, save the inmost, where none can arrive but through the rest; or else the Walls must be extrem thick for secret Passages. And yet this also will not serve the Turn, without at least three Doors to every Room; a Thing most insufferable in cold and windy Regions, and every where no small weakening to the whole Work. Therefore with us, that want no cooling, I cannot commend the direct Opposition of such Overtures, being indeed merely grounded upon the fond Ambition of displaying to a Stranger all our Furniture at one Sight, which therefore is most maintained by them, that mean to harbour but a few: whereby they make only advantage of the Vanity, and seldom prove the Convenience. There is likewise another Defect (as Absurdities are seldom solitary) which will necessarily follow upon such a servile disposing of inward Chambers, that they must be forced to make as many common great Rooms as there shall be several Stories; which (besides that they are usually dark, a Point hardly